AD-A095 698 FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OH F/G 6/16
AERONAUTICAL KNOWLEDGE (SELECTED ARTICLES),(U)
JAN 81 W SHU-RONG, Y CHONG-HUA
UNCLASSIFIED FTD-ID(RS)T-1234-80 NL

1 OF 1
AD
A095698

END
DATE
FILMED
3-81
DTIC

FTD-ID(RS)T-1234-80

AD A095698

FOREIGN TECHNOLOGY DIVISION

AERONAUTICAL KNOWLEDGE

(Selected Articles)

DTIC ELECTE 1981 D

DDC FILE COPY

Approved for public release; distribution unlimited.

81 2 25 074

Accession For	
NTIS GRA&I	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A	

FTD-ID(RS)T-1234-80

EDITED TRANSLATION

FTD-ID(RS)T-1234-80 14 Janu~~ary 19~~81

MICROFICHE NR: FTD-80- C-001302

AERONAUTICAL KNOWLEDGE (Selected Articles)

English pages: 8

Sou~~rce~~: Hang K'ung Chih Shih, ~~Nr. 3, 1980~~

Country of origin: China
Translated by: SCITRAN
F33657-78-D-0619
Requester: FTD/TQTD
Approved for public release; distribution unlimited.

DTIC
ELECTE
MAR 2 1981
S D

D

THIS TRANSLATION IS A RENDITION OF THE ORIGINAL FOREIGN TEXT WITHOUT ANY ANALYTICAL OR EDITORIAL COMMENT. STATEMENTS OR THEORIES ADVOCATED OR IMPLIED ARE THOSE OF THE SOURCE AND DO NOT NECESSARILY REFLECT THE POSITION OR OPINION OF THE FOREIGN TECHNOLOGY DIVISION.	PREPARED BY: TRANSLATION DIVISION FOREIGN TECHNOLOGY DIVISION WP-AFB, OHIO.

TABLE OF CONTENTS

OPTICAL ILLUSIONS OF SPACE

Wang Shu-rong

Optical phenomena or sensations caused by electrical, mechanical or radiation stimuli are called optical illusions. In space, the flashing seen in the eyes of space travelers was caused by cosmic rays, and it can represent a real danger on long space voyages.

In 1969, the American astronauts of Apollo 11 saw flashing in their eyes during their journey to the moon; Soviet cosmonauts, during their orbiting of Earth also saw similar flashing. Because of these observations, the attention of scientists was directed toward these optical illusions of space.

If it can be said that the astronauts of Apollo 11 and 12 discovered the flashing in the eye phenomenon by accident, then, the astronauts of Apollo 13 purposely carried out observations of this phenomenon. When they closed their eyes or in periods of fatigue, in half their fields of vision, they saw flashing in the form of belts, pairs of points or blazing fires; all these forms of flashing were colorless. The astronauts of Apollo 14 described three types of flashing: stars, belts and clouds. In the flight of Apollo 16, one of the astronauts was wearing a specialized detection device for measuring stray or disruptive agents, and this device recorded cosmic ray particles which flew through the space craft. It seemed to be that the optical illusions the astronauts were seeing were caused by basic cosmic rays; the rays penetrated the walls of the spacecraft cabin, went through the structure of the eyes of the astronauts, and caused them to see flashing. The frequency of the flashing was generally 1-2 times a second.

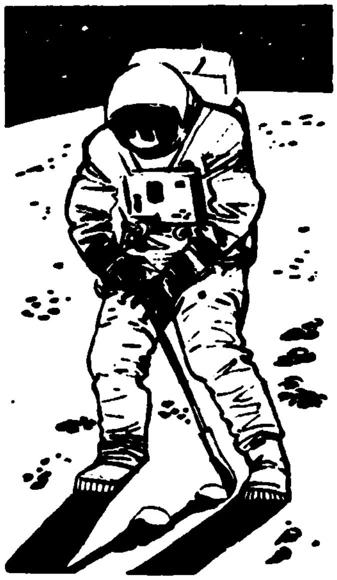
Some years before this, the phenomenon of optical illusions produced by electrical stimulation had first been described by Lai Luo-yi. During psycho-physical experiments on human subjects, it was normally observed to be possible that by placing an electrode on the forehead of the subject and another electrode on bones in the region of the eye the experimenters could cause the subject to see flashing through the use of electrical stimulation; the closer the electrodes were place to the eye, the lower the threshold values for the optical illusions became. Electrical stimulation of the cortex of the brain caused the cortex to produce optical illusions. This knowledge has already been used to experimentally produce equipment to assist the sight of blind people. For example, 80 platinum electrodes have been placed in the optical cortex of the cerebrum of a patient, then, electrodes and 80 miniature radio recievers were implanted in the area between the cranium and the skin of the head; after this, these recievers get signals from 80 radio transmitters inside the head of the blind patient. A television monitor that recieves these signals shows patches of light and dark corresponding to the shape of an observed object; these signals go through a sending and recieving system and cause the electrodes in the brain to function; becuase of this, certain definite flashing patterns form in the field of vision of the blind patient; in this way it is then possible to allow a blind patient to discern the shape and size of objects. X-rays striking the retina also produce flashing ; these are called optical illusions of radiation. In 1903, a Russian scientist observed that radium rays produced similar flashing perceptions in the eyes of affected individuals. Opthamologists and physicists decided that the optical illusions of radiation which were produced in the eyes of subjects exposed to radium rays were caused by the production of light by either the fluids within the eye or the retina itself. Optical illusions can also be caused by using particles produced by an accelerator. Several famous scientists and atronauts or cosmonauts were all able to observe phenomena similar to the space illusions when their eyes were penetrated by neutrons, protons and other particles.

When in orbit in the vicinity of Earth, space travelers did not observe the flashing in their eyes; even if they had, it would have been very slight. It should be pointed out that, under these conditions, the eyes of the spacemen are not completely adjusted to darkness. It is also possible that because radiation conditions were different during the flight to the moon than they were on the return flight to Earth. There were produced two different types of optical illusions during the course of the flight as a whole. In space near the Earth, due to the influence of Earth's magnetic field, the levels of radiation are low; at sea level, radiations received from space are almost all composed of μ mesons, electrons and protons; in space the levels of cosmic radiation can reach rates of 50 howards/day to include nuclear particles of hydrogen, helium, nitrogen, oxygen, carbon and iron, etc.

Currently, there are three hypotheses to explain the flashing in the eyes of space travelers. The first hypothsis is that eyes are biological detectors of heavy particles. The heavy particles of cosmic rays entering the eyes of spacemen from various directions hit the fluids of the eye and cause motion in those fluids which approaches the speed of light; this, in turn, becomes a source of radiation, and, in an eye accustomed to darkness, can be seen as flashing . The direct retinal excitation hypothesis says that, in space, the protons and heavy particles that are recieved by the receptors of the retina among the ions and cosmic rays entering the eye produce visual excitation. It has also been discovered that, by placing an alpha particle source on a freshly removed lens of an animal eye, one can produce visible flashing ; this experiment supports the "flickering" hypothesis for explaining the flashing phenomenon. To summarize the whole matter, at present there is still not enough experimental data in order to determine which hypothesis is correct.

Apparently, frequent flashing acts as a warning light to tell space travelers of the existence of belts of high radiation and alert them to the danger. Present and future missions must clarify the mechanism of the optical illusions of space in order to precisely determine what dangers may exist for the sight of space travelers on long space voyages

GRAPHICS: LIN ZHI-JUN LAYOUT: ZHANG ZHEN-YE



ZU CHONG-ZHI AND "FINITIZATION"

Yu Chong-hua

"Finitization", this is one of the most hotly debated topics in engineering technology circles at the present time, attracting the attention of more and more people. The current fame "finitization" now enjoys depends entirely on its proven effectiveness in solving the problems of engineering technology. Applications of "finitization" methods began first in the aero-space industry. Today, finitization methods have already become powerful tools of engineering analysis which are in use every day.

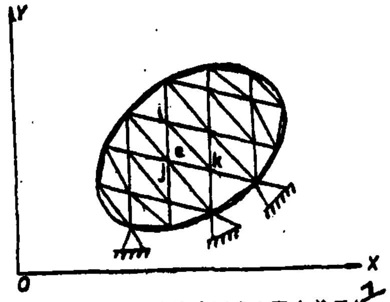
MATHEMATICAL FOUNDATIONS

Explaining it simply, "finitization" methods are calculation methods which depend on a kind of systemizing of numerical values gotten from differential equations. This technique takes for its mathematical foundation the principles of variation and division, and its development has been intimately related with the development of the computer.

Speaking from a mathematical point of view, what is reflected in the principle of variation is a generalized function (that is, a function of a function) of intrinsic extremes. Speaking from the point of view of physics, the principle of variation could also be called the principle of energy extremes. We know that all objects in the physical world, if they are in a state of equilibrium, must have their smallest potential energies in such a state. For example, when an apple falls from a tree, it always falls in the direction of the earth, and it definitely cannot fly off toward space of its own volition. After the apple in question has fallen to earth, it will usually bounce around a few times and, finally, come to rest in the place in that vicinity with the lowest relative potential energy; it will then stop moving and be in a state of equilibrium. At this time, the potential energy of the apple is at its lowest. The closely related principle of division is also a basic mathematical principle with which people in general are very familiar; in everyday life, its applications are regularly met with. For example, a carpenter can use a straight saw to cut a curved board, in such a case, the narrower the saw blade is the smoother the edge of the cut in the board will be. Or, another example would be the fact that we all know a curved line can be divided up into many small sections with each section representing a straight line; the more finely one divides up the curve the more closely each of the straight line sections will approximate its corresponding section of curve and the better the whole approximation is.

Finitization methods are methods of solving problems by applying these same methods of infinitesimal division to the basis of extreme values for potential energy in an engineering problem. It takes the entire structure of a body and divides it up into finite basic "units"; after this, it takes the total potential energy of the system and divides it up assigning a part of the total to each "unit"; finally, the calculation is reduced, mathmatically, to a matter of solving the general function of extreme values. Taking an example from solid mechanics, the basic idea of the finitization method is this: take a continuous body and divide it up into finite unit bodies (finite numerically, finite in terms of size). The shape of the unit body can be decided on the basis of the actual problem involved; it can be triangular, rectangular, any quadralateral one wishes, etc, (all this refers to problems in two dimensions) as well as tetrahedrons, conics, etc.,(these are used in solving problems in space). As shown in the figure, suppose that these unit bodies (e) are only concentrated or defined at the nodal points (i, j, k). Choose the displacement (or strength) of each nodal point to be the unknown quantity; then, for each unit body, apply the basic formulae of elasticity (plasticity) theory to calculate the stress and deformation for each unit (they are both functions of the displacement of the nodal points). After this, using all the conditions for static equilibrium and deformation of the nodal points, one forms up the units, adds in the boundary conditions above, and, from there, one can then form a set of large algebraic matrices relating to the unknown values of nodal points. After solving this set of equations, one can then obtain required stresses, strains, displacements and other related values.

It can also be clearly seen from Fig 1 that finitization methods are rather monotonous and rigid in form; because of this, the calculation process can be standardized, made orderly and, therefore, susceptible to computer applications. Because of this, not only can the calculation time be greatly shortened and efficiency increased, but, many complicated problems can be very conveniently solved. Because of the relatively flexible nature of finitization methods in terms of their basic units or division, by using a relatively small number of basic units, it is possible to approximate the surfaces of many kinds of complicated shapes. In components where stress tends to concentrate, it becomes possible to concentrate nodal points rather more closely together. According to the increase in the total number of nodal points and the minuteness of the basic bodies, it is possible to gradually increase the strength of the affected area in order to meet the requirements of the higher stress.



图一 把一个连续体分割成有限个单元体

Fig 1

1. Dividing a continuous surface up into finite or discrete basic units

Practical application bears out the effectiveness of these techniques; finitization methods can obtain very satisfactory approximate solutions for the needs of the engineering design process.

HISTORY OF DEVELOPMENT

Turning for a moment to the history of the basic principles on which today's finitization methods are based, everyone recognizes the fact that the earliest beginnings of finitization methods belong properly to the ancient history of our country and its famous mathmatician Zu Chong-zhi. Zu Chong-zhi (A.D. 429-500) was a Chinese scientist who lived in the southern dynasties area during the Northern and Southern Dynasties period. He calculated the value of π to be between 3.1415926 and 3.1415927; he also calculated π approximate value 22/7 and its precise value 355/113. In the process of calculating π, he used precisely the basic principles which are today used to support finitization theory. Because of this, we say that, early in the fifth century A.D., Zu Chong-zhi brought to light the earliest embryonic form of the idea of finitization. Because this idea did not achieve general importance or respect, it lay buried for a long time. Many centuries passed until the 1700's, when a Swiss mathematician came up with a similar idea of finitization; however, it too failed to attract any widespread interest. It was in the 1940's that an American mathematician deliniated the main points of the modern idea of finitization, but it did not attract a great deal more attention than did the earlier discoveries. It was not until the latter part of the 1950's that American structural engineering circles found a practical application for the technique in traditional methods of componentization; however, this was a very restricted application.

In the beginning of the 1960's, the technique of finitization began to earn the respect and interest of more and more people all over the world; fair numbers of scholars began theoretical research into the matter and produced quite a few specialized works on the subject; beyond this, several hundred international conferences were called in order to produce new developments in the theory of finitization. On the other hand, what is particularly worthy of note is the fact that the development of computers during this period was headlong and furious, and, for the application of finitization, this laid the concrete foundation. In the early 1960's, China, too, began to carry out research into the area of finitization. Comrade Feng Kang of the compuation center of the Academy of Sciences of China, by amalgamating practical application with theory and mathematics with mechanics, created a set of computational methods for solving elliptical differential equations and, thereby, developed the theory of finitization and received praise for his work from around the world. From the late 1960's onward, finitization has undergone rapid development; this development has taken place in the area of theory, of course; however, it has also extended to practical applications in which area it has achieved an unprecedented development. On a world-wide scale, there has been a high tide of commitment and effort to acheive great advances in finitization. At present, speaking in terms of the basic methods and theory of the technique, research into finitization is not finished yet. First class schools and academies in several countries have added lessons on finitization to their textbooks in mathematics, mechanics and several disciplines of engineering; this technique has become a lesson which must be learned by anyone involved in the field. Finitization is a technique of mathematical calculation which broadens the studies of science and the capabilities of industry; at present, it is the livliest area in the theory and practice of mathematical calculation. Not only has it opened up new directions in the theoretical analysis of and numerical solution of partial differential equations; moreover, it has caused the computational methods of abstract mathematics to be drawn deeply into the applications of mechanics and technical science, and it has promoted a deep cross-fertilization of scinetific disciplines. Representatives of the American Boeing company and Washington University recently used finitization methods to do structural strength calculations on super-sonic aircraft, and they were successful.

Fig 2 shows how finitization methods were used to do strength calculations for the Boing 747. At present, applications of finitization are spreading rapidly to many different engineering disciplines; they are already widely used in hydraulics, earthen construction, bridge building, machine design, mining, ship building, missles, elec-

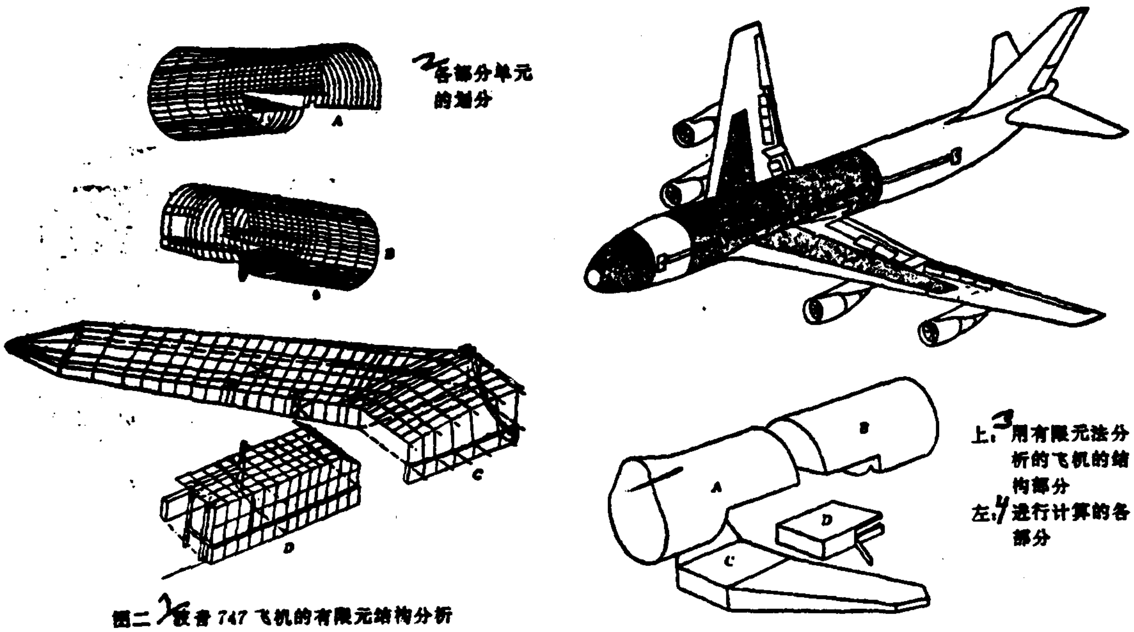


Fig 2

1. Finitization Structural Analysis of Boeing 747 2. Division of Various Components into Basic Units 3. Upper: Structural Components of Aircraft Analysed Using Finitization Method 4. Left: Several Components on Which Analysis Was Carried Out

tronics, electic generators and motors, hydrophonics, exploratory mining, hydrography, pollution, climate, ocean currents, earthquakes, solid mechanics, electrokinetics, fluid mechanics, heat conductance, atomic reactor piles, accelerators, medical science, etc., etc.: every type of scientific, technical and engineering discipline. Finitization has already become a necessity for engineering technologists and scientific workers; it has become one of their primary tools in carrying out numerical analyses. It should be pointed out that, in recent years, our country has achieved considerable successes in the field of finitization, both in theory and application; in future the development will be even greater.

GRAPHICS: WANG GUO-LUN

FILMED

3-8